

DECLARATION OF DR. GERALD L. HURST

Gerald L. Hurst, pursuant to the provisions of 28 U.S.C. §1746, makes the following declaration:

1. My name is Gerald L. Hurst. I am over the age of 18, and I currently reside in Travis County, Texas. I have never been convicted of a crime and I am fully competent to make this affidavit. Unless expressly stated otherwise, I either have personal knowledge of the facts stated herein or I have described the documents from which I have acquired my information. I believe the statements made in this declaration to be true and correct.
2. I am a chemist with extensive experience in the field of fire investigation and the underlying sciences. I graduated first in my college class and was awarded a National Science Foundation Fellowship. I earned my Ph.D. from Cambridge University. I was formerly Chief Scientist of the Atlas Powder Company, which was then the largest manufacturer of explosives in the United States. My consulting specialty is the debunking of junk science as it is practiced in the investigation of fires and explosions. I have over thirty years' experience in the field of fire and explosives research, beginning with research and development work on arson techniques for covert warfare during the Viet Nam war.
3. I have investigated numerous fires over the last forty years and testified many times as an expert in both state and federal courts about the cause and origin of fires, including fires in both structures and vehicles.

Hurst declaration
United States v. Bernard
Page 1

4. I was asked by the attorneys representing Brandon Bernard this case (*United States v. Christopher Vialva and Brandon Bernard*) to review the trial testimony and other evidence in this case relating to the intentionally set fire that destroyed the automobile of Todd and Stacie Bagley. Specifically, I was asked whether a reasonably well-informed fire investigation expert in 1999-2000 would have had any basis to dispute the testimony of Texas deputy state fire marshal Thomas Sing that one origin of the fire that consumed the Bagleys' vehicle was located "in the passenger compartment, ... on th[e] lower side behind the driver's seat, in the area of the floor pan." T.2084; *see also* T. 2093 (Mr. Sing's claim that extensive damage to the driver's side rear tire "show[s] or indicat[es] ... where the fire originate[d] on this vehicle"), T. 2094 (Mr. Sing's claim that the fire "originate[d] from" that location immediately behind the driver's seat "and move[d] up and away from this point to affect the rest of the vehicle"). Mr. Sing based this conclusion on his opinion that this location was where the fire had burned "the longest and with the most amount of damage." T. 2085. He stated that the fact that "the rear of the driver's side front seat ha[d] failed [and] fallen back into the floor pan area" was "another indication that the origin of the fire" was "behind the driver's side front seat," "in the floor of the rear seat." T. 2091. Asked by the prosecutor whether it was "possible ... for someone to be standing on [that] side of the vehicle and throw a match or [light the fire in some other manner] to where it would burn hottest here

because there was more accelerant there?,” Mr. Sing answered, “Yes sir, that’s correct.” T. 2086.

5. As a scientific matter, one cannot reliably infer from the physical evidence in this case where the fire inside the Bagleys’ car started, because of the extensive damage to the interior of the Bagleys’ vehicle, almost certainly as a consequence of post-flashover burning.
6. NFPA 921 defines flashover as “A transitional phase in the development of a compartment fire in which surfaces exposed to thermal radiation reach its ignition temperature more or less simultaneously and fire spreads rapidly throughout the space resulting in ... total involvement of the compartment or enclosed area.” An example of flashover is when a piece of combustible material is ignited inside an enclosed space (*e.g.*, a room in a house, or the inside of an automobile passenger compartment). The fire involving this initial piece of fuel can produce a layer of hot smoke which spreads across the ceiling in the room. Because it is bounded by the enclosed space, this buoyant layer of hot smoke grows in depth, extending toward the floor of the enclosed space. Radiated heat from this layer heats the surfaces of all directly exposed combustible materials in the enclosed space, causing them to give off flammable gases via pyrolysis. When the temperatures of the evolved gases become high enough, these gases will ignite. At that point, most of the directly exposed combustible material in the enclosed area will ignite, essentially simultaneously. That is the phenomenon we call flashover.

7. Post-flashover burning, even of relatively short duration, can result in severe and extensive damage inside the passenger compartment of a car like the Bagleys'. This is because the ratio of combustible items to area inside a vehicle is much greater than would be found inside a normal structure. In the past, automobile passenger compartments did not contain nearly the fuel load or ignition sources seen in modern vehicles. Older seats were cotton batted with cloth upholstery, and dashboards were often painted metal or had minimal plastic material; the headliners may have been fiberboard or minimally upholstered. In modern vehicles, the fuel loading in the passenger compartment is much greater, because the furnishings are manufactured of mostly synthetic (plastic and resin-based) materials, many of which are highly combustible. Therefore, if sufficient oxygen becomes available during post-flashover burning, as by the collapse of vehicle windows that were closed when the fire was ignited, the resulting damage will be extensive.
8. As the severity of fire damage increases, it becomes impossible to differentiate between the ignition source and first fuel ignited (the cause), and non-causative heat sources and secondary fuel packages (the effect). It is recognized now, and it was recognized in 1999, that when a passenger compartment fire in a vehicle progresses to the point of flashover and subsequent full involvement, all fire flow and intensity patterns will be erased. As a consequence, it will rarely be possible reliably to determine from the physical evidence exactly where the fire originated. From my review of the evidence in this case, it is my opinion that the Bagleys'

vehicle sustained this degree of damage; indeed, I would describe the interior of the vehicle as completely gutted. Given the extraordinary amount of damage caused by post-flashover burning inside the passenger compartment, accompanied by the collapse of the previously closed windows and the introduction of unlimited oxygen to the fire, it is impossible to draw any reliable inference about where the fire started inside the Bagleys' car.

9. These characteristics of post-flashover burning had been demonstrated in controlled experiments prior to 1999-2000, and the results of that research were widely known and understood by qualified fire investigators in the same time period. Had Mr. Bernard's trial attorneys consulted their own independent fire investigation expert in 1999-2000, that person would have been familiar with these processes and how they would apply to understanding the fire that destroyed the passenger compartment of the Bagleys' car. This fact is demonstrated by the contents of the following studies, articles, and documents, among others:

- a. the first edition of NFPA 921, "A Guide to Fire and Explosion Investigation," published by the National Fire Protection Association in 1992. This landmark publication was developed by a committee of over 30 well-respected fire experts elected by NFPA members. It was assembled through a process which met all the requirements of an ASTM standard. NFPA 921 has since become the *de facto* standard of care for the fire investigation community;

- b. Subsequent issuances of NFPA 921 in 1995 and 1998;
- c. USFA Fire Burn Pattern Tests, FA 178, 7/97 Federal Emergency Management Agency, United States Fire Administration, 1997;
- d. “Unconventional Wisdom: The Lessons of Oakland,” *The Fire and Arson Investigator*, Vol. 43, No. 4 (June 1993).
- e. “The Lime Street Fire: Another Perspective,” *The Fire and Arson Investigator*, Vol. 43, No. 1 (Sept 1992).

10. Simply put, Mr. Sing’s opinion that the fire likely originated immediately behind the driver’s seat, because it burned “longest and with the most ... damage” there, is not supported by what was known in 1999-2000 about the characteristics of post flashover burning. There was no remaining accelerant inside the vehicle because the fire burned it away, and any original marks that accelerant may have left were overwhelmed by plastic burning inside the passenger compartment. The progress of post-flashover burning inside an enclosed space is mainly dependent on ventilation. If the driver’s side rear window failed first, that alone could account for the damage that Mr. Sing’s opinion attributed to that area’s having burned “longest.” Conversely, if the passenger’s side rear window failed first, eddies of the prevailing wind sweeping into and across the passenger compartment could cause the same effect.

11. Similarly, there is no basis in science for Mr. Sing’s inference that the fire must have burned longer behind the driver’s seat because the seat itself collapsed. The

collapse of the seat could have just as easily been caused by radiating heat in post-flashover burning. Once the seat collapsed and fell backward, the seat itself would have radiated heat onto the area beneath it, reinforcing the intensity of the heat being radiated onto that area and increasing the degree of damage below and behind the seat. This is the same principle one sees at work when a pile of logs in a fireplace is set on fire using newspaper. The logs' surfaces radiate the heat from the burning newspaper onto one another, mutually reinforcing the radiant heat until the temperature rises to a point at which the logs themselves ignite. Similarly, if the back of the driver's seat ignited in post-flashover burning, and the seat then fell backward, the resulting damage behind and underneath the seat would be indistinguishable from that caused by a pool of burning accelerant in the rear floorboard.

12. In short, an appropriately qualified fire investigation expert in 1999-2000 would have been able to employ this scientific knowledge about the impact of post-flashover burning in vehicle fires to dispute Mr. Sing's opinion that the fire in the Bagleys' car likely started directly behind the driver's seat.

13. Further, had Mr. Bernard's trial counsel consulted an appropriately qualified fire investigation expert in 1999-2000, that expert would have informed them that the physical evidence in this case is equally consistent with the inference that the fire was started in the trunk of the car, where the Bagleys' bodies were located.

14. Stereo speakers mounted in holes cut into the rear deck of the passenger compartment provided a route through which fire could easily have traveled from the trunk into the passenger compartment. If, after lighter fluid was squirted or sprayed into the trunk area, a source of ignition was introduced and the trunk was closed, the fire would have flared up briefly inside the trunk. This fire could have then moved into the passenger compartment via the stereo speakers and the holes in which they were mounted. The cones or diaphragms of such speakers are typically made of highly flammable materials such as fabric, paper, or plastic. By burning through those flimsy barriers, the fire could in a matter of seconds reach the passenger compartment where it would spread rapidly because of the presence of both fresh air in the interior of the car, along with the hundreds of pounds of highly flammable fabrics and plastics that largely make up the interior furnishings of the vehicle, as well as any lighter fluid that might have been squirted or sprayed into the passenger compartment before the fire was lit in the trunk.
15. Most of the available combustibles inside the trunk did not actually burn because of the severely limited ventilation once the trunk was closed. Shortly after the trunk was closed, the fire would have died down or gone out for lack of oxygen regardless of the size of the fuel load. However, the speaker cones would have required only a very brief contact by the initial flame to ignite or disintegrate and allow the fire to spread to the plastics or lighter fluid in the passenger compartment where there was sufficient oxygen to sustain the flame.

16. Any suggestion in Mr. Sing's testimony that there was no open flame in the trunk has no basis in science. The "oxidation" (white color) on the left top of the trunk, which Mr. Sing attributes to an exterior open flame, is also present on the left interior of the lid on the supporting member. That supporting member's thermal contact with the sheet metal is poor. Thus, this damage to the supporting member was caused by heat from the interior destroying the paint and exposing the mineral content of the paint and/or primer. It had to be interior heat because there are portions which do not match any areas on the outside. The trunk springs on the left and right show the same effect. Moreover, there is a great deal of charred and missing fabric on the bodies of the victims. One cannot exclude open flame as the cause of this charring because there is no generally accepted scientific method for distinguishing between char from a flame and char from external heat. Any such suggestion would simply be an extension of the claim, once frequently made by fire investigators, that they could tell how hot or quickly a fire burned by the appearance of the char. That claim is an "old wives' tale" lacking any scientific basis.


17. Mr. Sing's statement that "anterior portions" of the car trunk "exhibited effects from heat exposure, but not direct exposure to flames," T. at 2110, is also misleading if the jury understood it as evidence that the fire started in the passenger compartment. For one thing, the trunk lid was protected by the prevailing wind, which was blowing the flames from the passenger compartment forward (i.e.,

toward the hood of the car), and in any event the top of the lid still saw a good amount of radiated heat. The overall prolonged heat in the trunk probably came mainly by conduction from the steel firewall between the trunk and the passenger compartment, augmented by gasoline and a tire burning under the car.

18. To be clear, it is not my opinion that the fire in the Bagleys' car *definitely* started in the trunk and spread to the passenger compartment. Because of the degree of damage inflicted on the passenger compartment as a result of post-flashover burning, it is not possible to draw a scientifically reliable inference about precisely where the fire started. But the physical evidence is just as consistent with the inference that the fire started in the trunk as it is with the inference that it started in the passenger compartment immediately behind the driver's seat, as Mr. Sing opined. Nothing in the physical evidence rules out the possibility that the fire started in the trunk and spread to the passenger compartment, and nothing makes Mr. Sing's hypothesis any more likely than the possibility that the fire started in the trunk and spread to the passenger compartment.

I declare under penalty of perjury that the foregoing is true and correct.

Executed at Austin, Texas, on 10/22/2012 (date).


Gerald L. Hurst

409 935 8305

GALVESTON CO. M.E.

09:51:14 a.m. 10-25-2012

2 / 7

DECLARATION OF STEPHEN PUSTILNIK, M.D.

Stephen Pustilnik, pursuant to the provisions of 28 U.S.C. §1746, makes the following declaration:

1. My name is Stephen Pustilnik. I am over the age of 18, and I currently reside in Harris County, Texas. I have never been convicted of a crime and I am fully competent to make this affidavit. Unless expressly stated otherwise, I either have personal knowledge of the facts stated herein or I have described the documents from which I have acquired my information. I believe the statements made in this declaration to be true and correct.
2. I am the Chief Medical Examiner for Galveston County, Texas, and an Assistant Professor of Pathology for the University of Texas Medical Branch. I am board certified in both Anatomic and Forensic Pathology by the American Board of Pathology and I am a licensed physician in the state of Texas.
3. I received my BA from the University of Pennsylvania and my MD from the Washington University School of Medicine. I interned at the University of Connecticut and did my residency at the Yale University School of Medicine. I did my fellowship in Forensic Pathology at the Dade County Medical Examiner Office.
4. At the request of Robert C. Owen, attorney for Brandon Bernard, I have reviewed materials in the case of *United States v. Christopher Vialva and Brandon Bernard*. Those materials included the report of the autopsy of Mr. Todd Bagley, performed by Southwest Institute of Forensic Sciences, the report of the autopsy of Mrs. Stacie Bagley, performed by Southwest Institute of Forensic Sciences,



photographs of the crime scene, photographs from the autopsies, and the trial testimony of Dr. Joni McClain, Dr. J.K. Townsend-Parchman, and Dr. Robert Bux.

5. The report of the autopsy of Mrs. Bagley describes and identifies black soot as being present in Mrs. Bagley's central and distal airways. The report also notes a toxicology analysis demonstrating a carboxyhemoglobin of 45%. The report also indicates that Mrs. Bagley's brainstem was not directly affected anatomically by the projectile that caused her gunshot wound.
6. During Dr. McClain's testimony at trial, the prosecutor asked her to describe her findings regarding Mrs. Bagley's cause of death. Dr. McClain responded that the "[c]ause of death was gunshot wound of the head associated with smoke inhalation and thermal injury." T. 2057. Asked further whether "the portions of [Mrs. Bagley's] brain that were hit with this -- by the bullet" had "cause[d] death in Mrs. Bagley immediately," Dr. McClain answered, "No," explaining that Mrs. Bagley at the time she was shot "most likely would've been unconscious." T. 2061. Asked by the prosecutor whether the bullet struck "any areas of the brain that are vital ... that would 've caused instant death," Dr. McClain responded, "No," adding that "[u]sually, the ... brain stem is the portion of the brain that is an instantaneous death, and that was not hit." T. 2061. Dr. McClain further testified that her examination during the autopsy of Mrs. Bagley's larynx, trachea, and bronchi revealed that "there was soot deposition lining [those airways], so that indicates that she's inhaling smoky, sooty material." T. 2061-62. She added



that "a toxicologic examination of [Mrs. Bagley's] blood ... showed a carbon monoxide level of 45 percent," which indicated that Mrs. Bagley was "breathing in those products of smoke, and that certainly contribute[d] to [her] death." T. 2062. She later agreed with the prosecutor's characterization of this effect as "smoke inhalation" which was a "contributing cause" to Mrs. Bagley's death. T. 2062.

7. The hypothesis that Mrs. Bagley remained alive and breathing after sustaining a gunshot to the face is one hypothesis that explains the presence of soot in her airways and the carbon monoxide in her blood. In my opinion, there is an alternative explanation which is equally possible and consistent with the evidence from the autopsy.
8. To understand this alternative explanation, it is necessary to appreciate the distinction between medical death and forensic death. An individual is medically dead when either brain death or cardiac death has occurred, even though other autonomic functions may still be ongoing. Those functions are physiochemically driven, not voluntarily mediated. For example, the heart can continue to beat for 30-45 minutes after a fatal head injury, such as a gunshot wound. Medical death marks an important point because, for example, an organ donor who is medically dead can have his organs removed for donation and transplantation.
9. While the heart is beating, blood is circulating in the body and carbon dioxide levels in the bloodstream are rising. The medically dead body's physiochemical response to rising carbon dioxide levels in the blood stream,



in the presence of a persistent agonal heartbeat, is to produce diaphragmatic movement which is mediated through the peripheral chemical receptors in the cardiovascular system and the respiratory centers in the brainstem.. This diaphragmatic movement, in turn, produces persistent agonal diaphragmatic movement and respiratory effort – a “bellows” effect that results in the movement of air from the surrounding environment into the airways of the medically dead body. This agonal respiratory effort is a deep primitive reflex and has nothing to do with consciousness or any higher brain function.

10. By contrast to medical death, an individual is forensically dead only when all physiologic and agonal activity has ceased.
11. Mrs. Bagley suffered a gunshot wound to the head that did enter her brain. Any gunshot wound to the brain can be both immediately incapacitating and immediately fatal whether or not it directly damages the brain stem.
12. One may reasonably conclude from the evidence I have reviewed that Mrs. Bagley, who had suffered an unsurvivable gunshot wound that damaged the structures of her brain, was medically dead after sustaining that injury. That Mrs. Bagley would ultimately arrive at forensic death, as a result of the damage from this gunshot, was a foregone and inevitable conclusion.
13. Even if Mrs. Bagley was medically dead after sustaining this gunshot injury, physicochemically driven autonomic functions were taking place for some period of time. As noted, the heart can continue to beat for 30-45 minutes after a fatal head injury. This continuing, but inexorably slowing heartbeat is called a “persistent agonal heartbeat.” In the circumstances of

409 935 8305

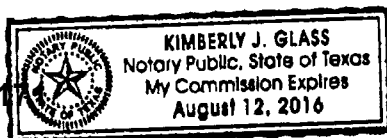
GALVESTON CO. M.E.

Mrs. Bagley's case, this agonal respiratory effort and agonal circulation, occurring in the wake of traumatic brain injury and in an environment of high carbon monoxide and high soot, could lead to soot being deposited throughout the airways, as well as high levels of carbon monoxide in the blood. All these effects would be subsequent to fatal traumatic brain injury, *i.e.*, traumatic brain injury that caused medical death.

14. This scenario is, in my opinion, an equally possible and more likely explanation for the postmortem finding of soot in the airways of Mrs. Bagley's body, as well as carboxyhemoglobin of 45% in her blood. In this situation, the fire may not have contributed to Mrs. Bagley's death. I do not believe that there was passive diffusion of the smoky environment down through the airways of Mrs. Bagley after she was shot.
15. If Mr. Bernard's attorneys had contacted any reasonably competent pathologist in 1999-2000, that person could have explained to counsel the distinction between medical death and forensic death, and how the autopsy findings with respect to the soot in Mrs. Bagley's airways and the carbon monoxide in her blood are consistent with physiological processes occurring in the wake of medical death from traumatic brain injury. That information, in turn, could have supported an argument that the person who set fire to the Bagleys' car did not cause Mrs. Bagley's death.

I declare under penalty of perjury that the foregoing is true and correct.

Executed at SCMEC (place) on 10-25-2012 (date).



Kimberly J. Glass

Exhibit C - Declaration of Dr. Stephen Pustilnik

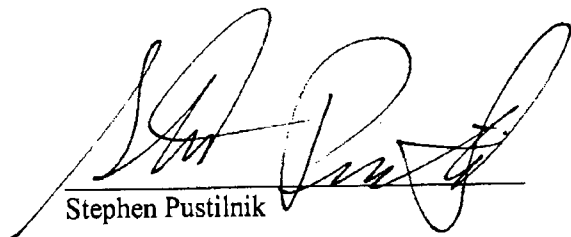
Received Fax : Oct 25 2012 10:31AM Fax Station : DEFENSECLINIC p. 7

409 935 8305

GALVESTON CO. M.E.

09:52:19 a.m. 10-25-2012

7/7



Stephen Pustilnik